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⑵ Remote control system for hearing aids.

⑶ The remote control of an operational parameter, such as the amplification factor (A) of the amplifier (19), of a hearing aid (1) occurs via acoustic waves (11) transmitted by a transmitter (10) of a remote control unit (2) and received by a pick-up (15) of the hearing aid (1). The acoustic waves can be ultrasonic waves or modulated waves.

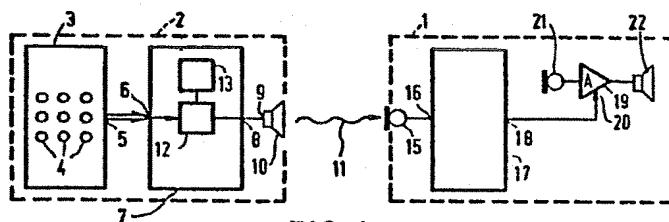


FIG. 1

Remote control system for hearing aids.

The invention relates to a combination of a hearing aid, being adapted to be supported upon the head of a user of the aid, and a remote control unit, the remote control unit comprising, control means, that can manually be operated by the user, an encoder 5 unit having an input coupled to the control means and an output, and a transmitter having an input coupled to the output of the encoder unit, the encoder unit being adapted to convert control operations carried out by the user on the control means into a first control signal and to apply this first control signal via its output to the transmitter, for 10 the wireless transmission of the first control signal, the hearing aid comprising a pick-up for receiving the first control signal transmitted by the transmitter of the remote control unit, a decoder unit having an input coupled to the pick-up for receiving the first control signal and an output, the decoder unit being adapted to 15 convert the first control signal into a second control signal for controlling at least one operational parameter of the hearing aid. The invention further relates to a remote control unit and a hearing aid for use in the combination. The combination described in the opening paragraph is known from German Offenlegungsschrift 1.938.381.

20 Headworn hearing aids of the eyeglass, behind-the-ear, in-the-ear or in-the-earcanal type generally contain a miniature microphone and a miniature receiver as well as an electronic amplifier for signal amplification and/or filtering.

With hearing aids becoming ever smaller as well as more 25 reliable the on-off switch and the volume control are becoming more and more of a problem. Manipulation of the ever smaller buttons especially for elderly people is a problem, while the switches and controls are generally the weakest part of the aid and more than other elements of aids subject to the environmental conditions.

30 A solution for the problems described above can be found in the above-mentioned German Offenlegungsschrift 1.938.381. By means of the inductive coupling between coils in the remote control unit and the

hearing aid it is possible to change the operational parameters of the aid, such as switching the aid on and off, changing the amplification factor of the amplifier or amending the frequency response characteristics of the aid.

5 However, coils occupy a large amount of space, which is sometimes even not available at all, such as in the in-the-earcanal type. This means that the hearing aids are either very bulky, or it is not even possible to apply a remote control to the aid, which remote control can hardly be dispensed with in the in-the-earcanal type hearing
10 aid.

The invention aims at providing an other way of realizing the remote control of the hearing aid, such that the hearing aids can remain rather small and occupy a smaller amount of space, which means that the remote control of the in-the-earcanal type hearing aid will be
15 possible. To that purpose the combination is characterized in that the wireless transmission of the first control signal takes place by means of acoustic waves.

The inventions is based on the recognition that the transmission of acoustic waves makes it necessary to use a pick-up in
20 the form of an acousto-electric transducer. Such transducers can be smaller than a coil, so that a saving of space can be obtained.

The invention describes a system to control a hearing aid remotely by means of a hand-held device which is brought in the vicinity of or held against the hearing aid concerned. Control is
25 through more or less simple sound signals originated by the handheld unit and received by the pick-up of the aid.

Especially in a hearing aid comprising a series arrangement of a microphone, an amplifier and a receiver, the said microphone can function as the pick-up for receiving the first control
30 signal. In this case, no additional element for the pick-up is needed, which realizes an even larger saving of space, so that the hearing aid can be even smaller. Furthermore a saving in energy can be obtained because there is no transducer now instead of two for the receiving of the speech signals and the control signal. However this means that
35 filter means are needed for deriving the first control signal from the output signal of the microphone, an output of the filter means being coupled to the input of the decoder unit.

The first control signal can lie in a frequency region which is outside the operating frequency range of the receiver. In this case, one makes use of the general characteristic of modern miniature transducers which enable miniature microphones to be made much more wideband (say up to 12, 15 or 20 kHz) than receivers (hearing aid telephones) which, because of their own frequency characteristic as well as the influence of the acoustic coupling of the earcavity to the receiver, generally does not extend beyond 6 or 7 kHz.

This difference in bandwidth is used to bring the first control signal into the aid to switch the aid on or off, or to change volume, frequency-settings or other operational parameters of the aid, without disturbing the user of the aid.

The first control signal is simply picked up by the microphone but cannot be reproduced by the receiver with its specific termination.

It should be noted that, if a remote control of the on/off function of the hearing aid is contemplated, the pick-up - and in those cases where the microphone of the hearing aid functions as the pick-up, the microphone - as well as the decoder unit in the hearing aid should be permanently switched on.

The wireless transmission of the first control signal can take place by means of ultrasonic waves. This means that the frequency of these waves lie outside the frequency range of normal hearing.

It should be noted here that the wireless transmission of signals by means of ultrasonic waves is known per se from German Gebrauchsmuster 73.11.755. However said Gebrauchsmuster concerns the wireless transmission of audio information from an audio system to a headphone. This means that it does not describe the wireless transmission of a control signal for the remote control of an operational parameter of a hearing aid.

An other possibility is that the wireless transmission occurs via modulated acoustic waves. This makes the combination less sensitive for disturbing acoustic signals originating from other sources. The first control signal can be transmitted in amplitude-modulated or frequency-modulated form. This means that the encoder unit in the remote control unit comprises a modulator in order to modulate the control signal, and the decoder unit in the hearing aid comprises a

demodulator in order to demodulate the control signal received.

However, it should be noted here that other encoding techniques can alternatively be applied, such as an encoding based on tone combinations (e.g. the so-called "dual tone multi frequency" system, as applied in the transmission of dialling information over telephone lines).

The following figure description describes the invention in more detail with reference to the accompanying drawing. In the drawing shows

10 figure 1 a first embodiment,

figure 2 another embodiment of the hearing aid in the combination and

figure 3 again another embodiment of the hearing aid in the combination.

15 Figure 1 shows an embodiment of the combination of a hearing aid 1 and a remote control unit 2, both elements being shown only schematically, in the form of block diagrams. The remote control unit 2 comprises control means 3, e.g. in the form of a tablet having control buttons 4. The output 5 of the control means 3 is coupled to an input 6 of an encoder unit 7. An output 8 of the encoder unit 7 is coupled to an input 9 of a transmitter 10, which is in the form of a loudspeaker. The encoder unit is adapted to convert control operations carried out by a user of the hearing aid on the control means 3 into a first control signal and to apply the first control signal via its 20 output 8 to the transmitter 10, for the wireless transmission of the first control signal, which wireless transmission takes place by means of acoustic waves 11. The transmission can take place by means of ultrasonic waves. This means that the transducer 10 is an ultrasonic transducer.

25 30 The transmission of the first control signal can alternatively take place by means of modulated acoustic waves. In that case, the encoder unit 7 comprises a modulator 12 and an oscillator 13. Operating a button 4 of the control means 3 influences either the frequency of the oscillator, or the amplitude of the oscillator, in 35 which case one obtains a frequency-modulated or an amplitude-modulated signal at the output 8 of the encoder unit 7.

The hearing aid 1 comprises a pick-up 15 for receiving

the acoustic waves 11 transmitted by the transmitter 10 of the remote control unit 2. The first control signal received is fed to an input 16 of a decoder unit 17. The decoder unit 17 is adapted to convert the first control signal into a second control signal for controlling at least one operational parameter of the hearing aid 1. In the present case the second control signal influences the amplification factor A of an amplifier 19 in the hearing aid. To that purpose the output 18 of the decoder unit 17 is coupled to a control input 20 of the amplifier 19.

5 The hearing aid generally comprises a microphone 21 coupled to the amplifier 19 and a loudspeaker (or telephone) 22.

10 The decoder unit 17 comprises a demodulator (not shown) to demodulate the first control signal if it is transmitted in frequency- or amplitude-modulated form.

15 It will be evident that between successive manipulations of the buttons on the remote control unit 2 the value of the second control signal should remain at the level as adjusted. To that purpose the decoder unit 17 comprises a memory in which the level of the second control signal can be stored after each manipulation of a button on the remote control unit 2.

20 Figure 2 shows an other embodiment of the hearing aid, denoted by the reference numeral 1'. The pick-up 25 also functions as the microphone of the aid. This means that the output of the pick-up 25 is also coupled to the input of the amplifier 19. Filter means 26 are included between the microphone 25 and the decoder unit 17. In order to 25 derive the first control signal from the output signal of the microphone 25. The filter means 26 can include a band-pass filter covering that frequency range in which the frequency of the first control signal lies. Because, in general, the telephone 22 exhibits, because of its acoustical coupling to the earcavity, a limited operating frequency 30 range, up to say 6 or 7 kHz, compared to the operating frequency range of the microphone 25, which is say up to 12, 15 or 20 kHz, one can modulate the first control signal into the frequency region above 7 kHz and below the upper limit frequency of the operative frequency range of the microphone. In that case no bandstop filter is needed in the 35 connection between the point 27 and the amplifier 19 to prevent the first control signal from being reproduced by the telephone 22. The embodiment of figure 2 again shows a control of the amplification factor

A of the hearing aid amplifier 19.

Figure 3 shows an embodiment of a hearing aid 1' in which the on-off switch 30 can be manipulated remotely. Switching the on-off switch 30 on realizes a supply voltage V from a battery 31 incorporated in the aid to be fed to the power supply terminal 32 of the amplifier 19 of the aid. In order that the remote control for switching the hearing aid on and off should function properly, the microphone 25 and the decoder unit 17 are permanently coupled to the supply voltage V by means of the connections 33 and 34. The same is valid for the band-pass filter 26 if it is an active filter.

It is evident that, in addition to the remote control of the on-off switch 30, other operational parameters such as the amplification factor A, as described with reference to figure 1 and 2 can be controlled remotely. This implies that more first control signals than only one, having different frequencies or different codes, are used, transmitted via acoustic waves having different frequencies or different codes, picked up by the pick-up and converted in the decoder unit into more than one second control signals to control the relevant operational parameters of the aid.

CLAIMS

1. A combination of a hearing aid, being adapted to be supported upon the head of a user of the aid, and a remote control unit, the remote control unit comprising,
control means, that can manually be operated by the user, an encoder
5 unit having an input coupled to the control means and an output, and a transmitter having an input coupled to the output of the encoder unit, the encoder unit being adapted to convert control operations carried out by the user on the control means into a first control signal and to apply this first control signal via its output to the transmitter, for
10 the wireless transmission of the first control signal, the hearing aid comprising a pick-up for receiving the first control signal transmitted by the transmitter of the remote control unit, a decoder unit having an input coupled to the pick-up for receiving the first control signal and an output, the decoder unit being adapted to
15 convert the first control signal into a second control signal for controlling at least one operational parameter of the hearing aid, characterized in that the wireless transmission of the first control signal takes place by means of acoustic waves.
2. A combination as claimed in Claim 1, characterized in
20 that the wireless transmission of the first control signal takes place by means of ultrasonic waves.
3. A combination as claimed in Claim 1 or 2, characterized in that the wireless transmission of the first control signal takes place by means of modulated acoustic waves.
- 25 4. A combination as claimed in Claim 1, 2 or 3, the hearing aid comprising a series arrangement of a microphone, an amplifier and a receiver, characterized in that the microphone also functions as the pick-up for receiving the first control signal, filter means being provided for deriving the first control signal from the output signal of
30 the microphone, an output of the filter means being coupled to the input of the decoder unit.
5. A combination as claimed in Claim 4, characterized in that the first control signal lies in a frequency range which is outside

the operating frequency range of the receiver.

6. A combination as claimed in Claim 3, or any one of the Claims 4 or 5, as far as appended to Claim 3, characterized in that the encoder unit in the remote control unit comprises a modulator and the decoder unit in the hearing aid comprises a demodulator.

7. A remote control unit for use in a combination as claimed in any of the preceding claims, characterized in that the transmitter is in the form of a transducer for the conversion of electric signals into acoustic signals.

8. A hearing aid for use in a combination as claimed in any one of the Claims 1 to 6, characterized in that the pick-up is in the form of a transducer for the conversion of acoustic signals into electric signals.

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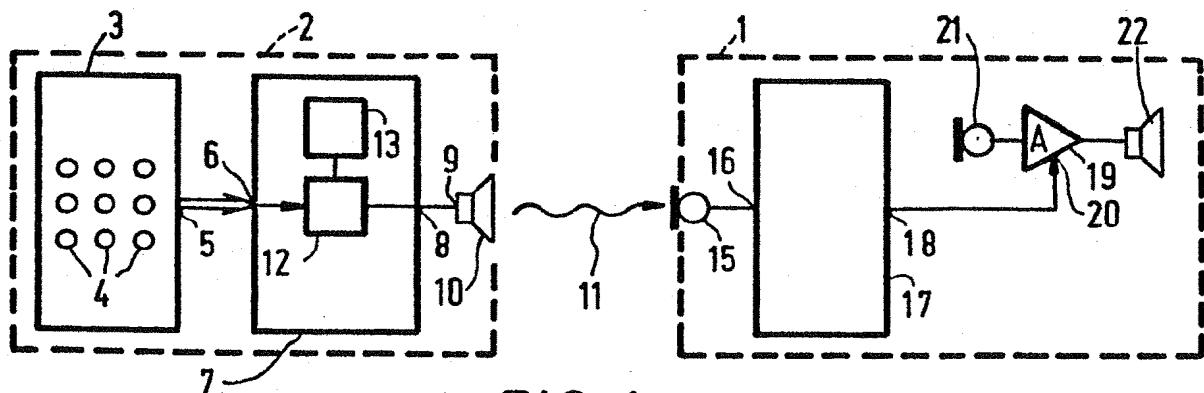


FIG. 1

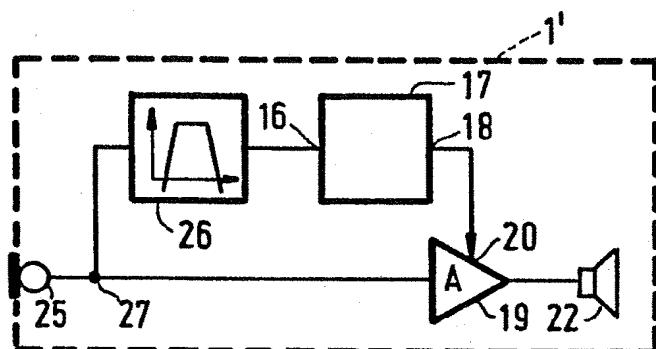


FIG. 2

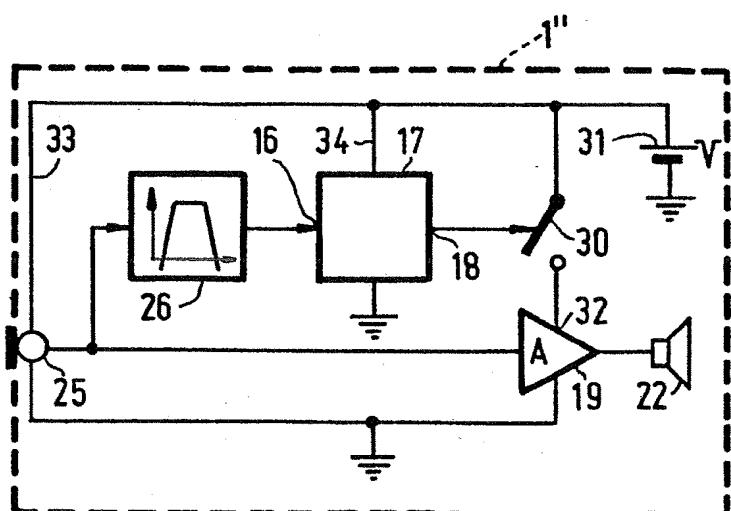


FIG. 3

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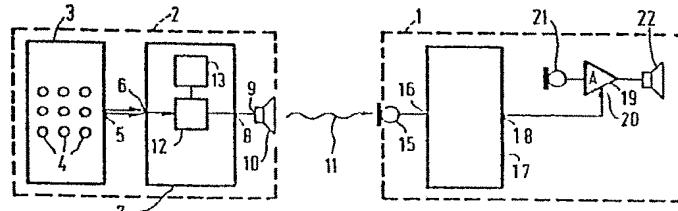


FIG. 1



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EUROPEAN SEARCH REPORT

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EP 85 20 1185

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl 4)
D, Y	DE-A-1 938 381 (SIEMENS AG) * Claims * ---	1	H 04 R 25/00 H 03 G 1/02
Y	DE-A-2 407 726 (SENNHEISER) * Whole document * ---	1	
A		2-8	
A	US-A-4 189 713 (N. DUFFY) * Claim 1 * ---	1-8	
A	DE-A-3 205 686 (R. BOSCH) * Claims; figures * -----	1-8	
			TECHNICAL FIELDS SEARCHED (Int. Cl 4)
			H 04 R H 03 G H 04 B G 08 C H 03 J
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	26-03-1986	MINNOYE G.W.	
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